

***Plumularia mooreana*, a new marine hydroid from French Polynesia (Hydrozoa, Cnidaria)**

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***Plumularia mooreana*, a new marine hydroid from French Polynesia (Hydrozoa, Cnidaria)** - A new species of *Plumularia* from Moorea is described. It is a member of the *P. setacea* species complex, being easily distinguishable from the latter through its large, truncate gonothecae provided with numerous nematothecae, as well as its shallow hydrothecae with a curved abaxial wall. Sterile colonies of the new species can be mistaken for *P. strobilophora*, though several reliable characters allow their distinction. The type material of *P. strobilophora* was re-examined for comparison and new illustrations are provided.

Keywords: Pacific - Tahiti - new species - *Plumularia strobilophora*.

INTRODUCTION

Hydroids of the genus *Plumularia* Lamarck, 1816, comprising about 90 potentially valid species, occur in all tropical to temperate seas (Schuchert, 2013). Most members of the genus more or less resemble the type species, *P. setacea* (Linnaeus, 1758), and species discrimination is often difficult due the paucity of available characters and a significant intraspecific variation (Schuchert, 2013). A comprehensive revision of the genus is highly desirable, as many nominal species are not objectively distinguishable or are inadequately described (comp. e. g. Calder *et al.*, 2009).

However, it is still possible to find undescribed *Plumularia* species which are unambiguously distinguishable from their congeners. While studying samples of *P. setacea* from around the world, several specimens of a *Plumularia* from Moorea (French Polynesia), collected by Drs Nicole Gravier-Bonnet, Alan Collins, and Gustav Paulay in 2009, were entrusted to me for study. They proved to belong to an unnamed species, whose description is provided herein.

TAXONOMIC PART

***Plumularia mooreana* n. spec.**

Figs 1-2

Plumularia strobilophora. – Ryland & Gibbons, 1991: 536, fig. 8. [not *Plumularia strobilophora* Billard, 1913]

HOLOTYPE MATERIAL: University of Florida Natural History Museum UF-7017; field number BM00-08101; Moorea, 17.55143°S 49.77698°W, 0-2 m depth, collected 06.12.2009, one fertile colony and several stems originating presumably from same colony, some stems with gonothecae, some detached gonothecae present.

PARATYPE MATERIAL: University of Florida Natural History Museum UF-6730; field number BMOO-06413; Moorea, 17.45747°S 149.83277°W, 10-20 m depth, collected 21.11.2009; 2 sterile plumes. – UF-6762; field number BMOO-06722; Moorea, depth 0-3 m, collected 23.11.2009; 5 sterile plumes. – UF-7026; field number BMOO-08110; Moorea, 17.55143°S 149.77698°W; depth 0-2, collected 06.12.2009; several small, sterile plumes.

DIAGNOSIS: *Plumularia* species with large gonothecae borne on basal part of stem, bearing numerous, scattered nematothecae; walls undulated, distal end broadly truncate, attachment site to stem basilateral. Hydrothecae very shallow, with curved abaxial wall. Lateral nematothecae distinctly funnel-shaped. Plumes small, unbranched.

DESCRIPTION: Relatively small, delicate, pinnate shoots arising from creeping stolons. Stems monosiphonic, regularly and distinctly divided by transverse nodes, each internode with a distal apophysis and two nematothecae: one in the upper axil of apophysis and one in the lower half of segment, on side opposite to apophysis. Perisarc thick at base, thinning out distally.

Hydrocladia alternate, on two opposite sides of the stem, carrying up to four hydrothecae; segmented heteromerously, distinct nodes delimiting main- and inter-segments (hydrothecate and ahydrothecate segments), proximal-most segment short and without nematothecae (athecate segment). Main segments elongate, proximal node oblique, distal node straight, with a hydrotheca in middle of segment and three nematothecae: one median inferior and two laterals. Intersegments variable in length, each with one median nematotheca, proximal node straight, distal node oblique. Both types of segments may have indistinct internal, annular ridges close to their ends.

Hydrotheca inclined approx. 45° to main axis of segment, bowl-shaped, shallow, ratio diameter/depth about 2, adcauline wall not completely adnate, abcauline wall thickened and in the majority of the hydrothecae of one plume distinctly convex (bulging), rim smooth to somewhat irregularly undulated, internal wall with a ring of numerous, conspicuous desmocytes (small perisarc knobs).

Nematothecae two chambered, movable, lateral pair conspicuously funnel-shaped, with a broad, distal aperture; as high or higher than hydrothecal depth, wall facing hydrotheca depressed.

One to two gonothecae on basal part of stem where no hydrocladia occur; thin-walled, bullet-shaped, base often curved, lateral walls straight to convex, variably undulated (annular bulges/swellings), distal end a large, flat, circular surface. Connection site to stem is basilateral. Numerous (up to 15 seen) nematothecae, more tubular than the laterals associated to the hydrotheca, are scattered over the surface of the gonotheca.

The measurements are given in Table 1.

REMARKS: The following publications were considered to compare the new species to other *P. setacea*-like hydroids: Allman (1877), Bale (1884), Billard (1913), Calder (1997), Fraser (1937, 1938, 1944, 1948), Hirohito (1995), Jarvis (1922), Mammen (1967), Migotto (1996), Millard (1975), Nutting (1900, 1906, 1927), Ralph (1961), Ryland & Gibbons (1991), Schuchert (2013), Vervoort & Vasseur (1977), Vervoort & Watson (2003), Watson (1973). A complete list of all *Plumularia* species was obtained from Schuchert (2012).

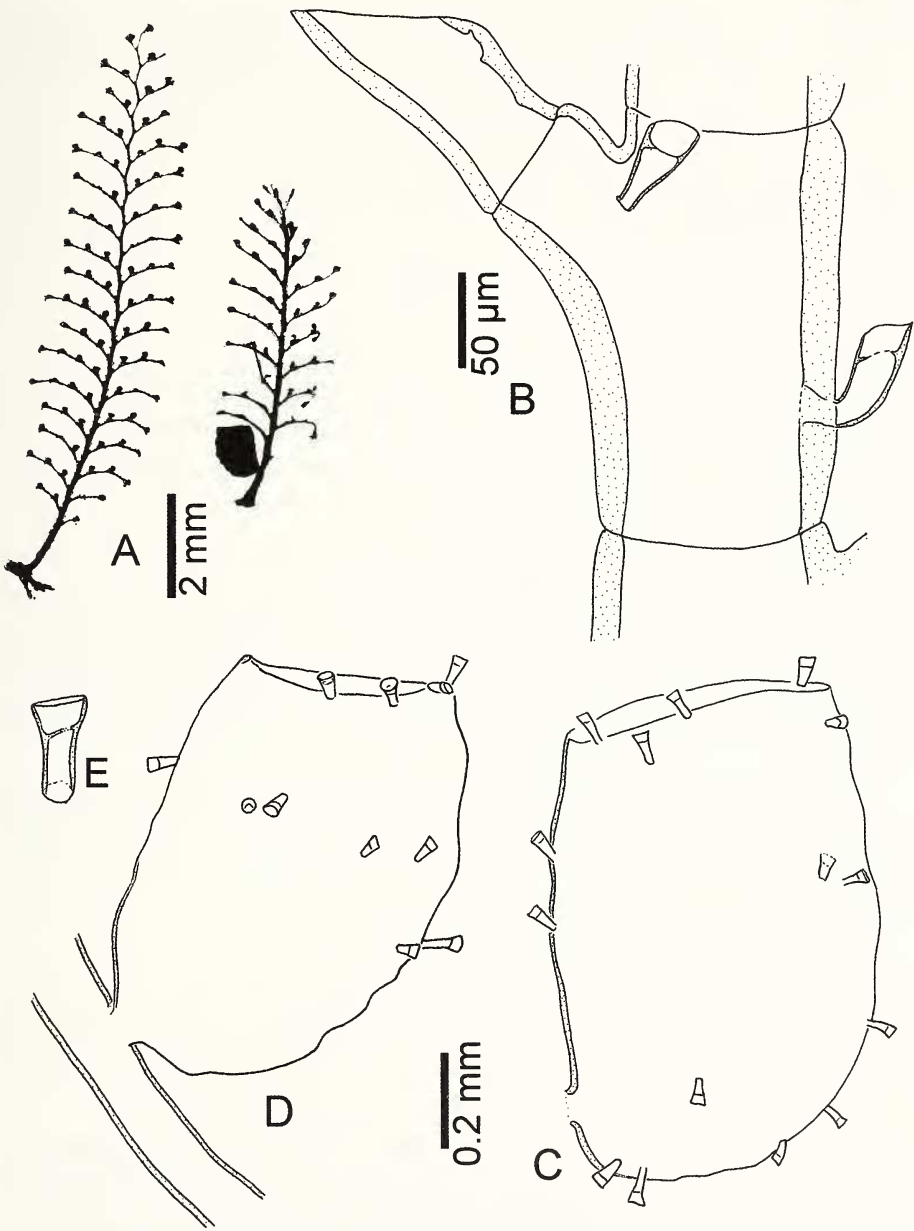


FIG. 1

Plumularia mooreana n. spec. (A) Silhouettes of two plumes: paratype (left), holotype (right). (B) Segment of stem with first, athecate segment of a hydrocladium, FU-6730. (C-D) Gonothecae, holotype. (E) Nematotheca of gonotheca, same scale as B.

Plumularia mooreana is a member of the large group of *P. setacea*-like hydroids (comp. Schuchert, 2013). It is, however, readily distinguished from the nearly cosmopolitan *P. setacea* through its different gonothecae, the shallower and more tilted hydrothecae, and the funnel-shaped lateral nematothecae.

The most characteristic feature of *P. mooreana* is found in its gonotheca, whose surface is covered with numerous nematothecae (Fig. 1B-C). Species belonging to the family Plumulariidae rarely have nematothecae on their gonothecae, a trait that is typical of the Halopterididae (Schuchert, 1997; the family also includes the genus *Polyplumularia*, see Peña Cantero *et al.*, 2010). The only known exceptions within the genus *Plumularia* are *P. wasini* Jarvis, 1922, *Plumularia australiensis* Watson, 1973, and some populations of *P. filicula* Allman, 1877 (see Vervoort & Watson, 2003). *Plumularia wasini* has 2-3 nematothecae on its gonothecae (Millard, 1975), but is otherwise rather different from *P. mooreana*: in having hydrothecae with a relatively long, free adcauline side and a straight abcauline side, a solitary nematotheca behind the hydrotheca, short main segments, gonothecae on hydrocladia, and stem-nematothecae in two rows. *Plumularia australiensis* closely resembles *P. wasini* and is therefore distinguishable from *P. mooreana* using the same characters listed for *P. wasini*. *Plumularia filicula* has normally no nematothecae on its gonothecae (comp. Ramil & Vervoort, 1992), but Vervoort & Watson (2003) described material from New Zealand which had a small gonothecae with two nematothecae. As already acknowledged by Vervoort & Watson (2003), the identity of this material is uncertain and it might represent another, undescribed species. The shape of the gonothecae and the hydrothecae of this material are very distinct from *P. mooreana* and both forms are clearly separable.

Although it is not particularly convex in *P. mooreana*, a curved outer abcauline hydrothecal wall is also uncommon in the genus *Plumularia*, being present in only a few congeners, e. g. *P. lagenifera* Allman, 1885, *P. gaimardi* (Lamouroux, 1924) (for a redescription see Schuchert, 2013), and *Plumularia caliculata* Bale, 1888. However, all of them have gonothecae that lack nematothecae.

The attachment of the gonotheca in the lower part of the stem is also seen in *P. strictocarpa* Pictet, 1893, but the gonothecae of this species have more distinct annular ridges and, again, bear no nematothecae. Moreover, its hydrothecae are different (deeper, straight walls). Both species occur sympatrically, as material of *P. strictocarpa* was collected concomitantly with *P. mooreana* (not shown, specimens UF-6820 & UF 7112 of the University of Florida Natural History Museum)

The trophosome of *P. mooreana* resembles most closely that of *P. strobilophora* Billard, 1913, notably regarding the rather shallow, strongly inclined hydrothecae. In the absence of gonothecae, the two species can be difficult to distinguish, and it seems that Ryland & Gibbons (1991) misidentified specimens of *P. mooreana* as *P. strobilophora*, although they noted the differences to descriptions given by other authors. In order to make sure that both species are clearly distinct, the type material of *P. strobilophora* was examined for this study (see below). Apart from the absence of nematothecae on the gonothecae, *Plumularia strobilophora* differs from *P. mooreana* in the following details: the first hydrocladial segment (athecate segment) is distinctly longer (comp. Figs 1B and 3A), there are 2-3 nematothecae on the stem apophyses (Fig. 3A),

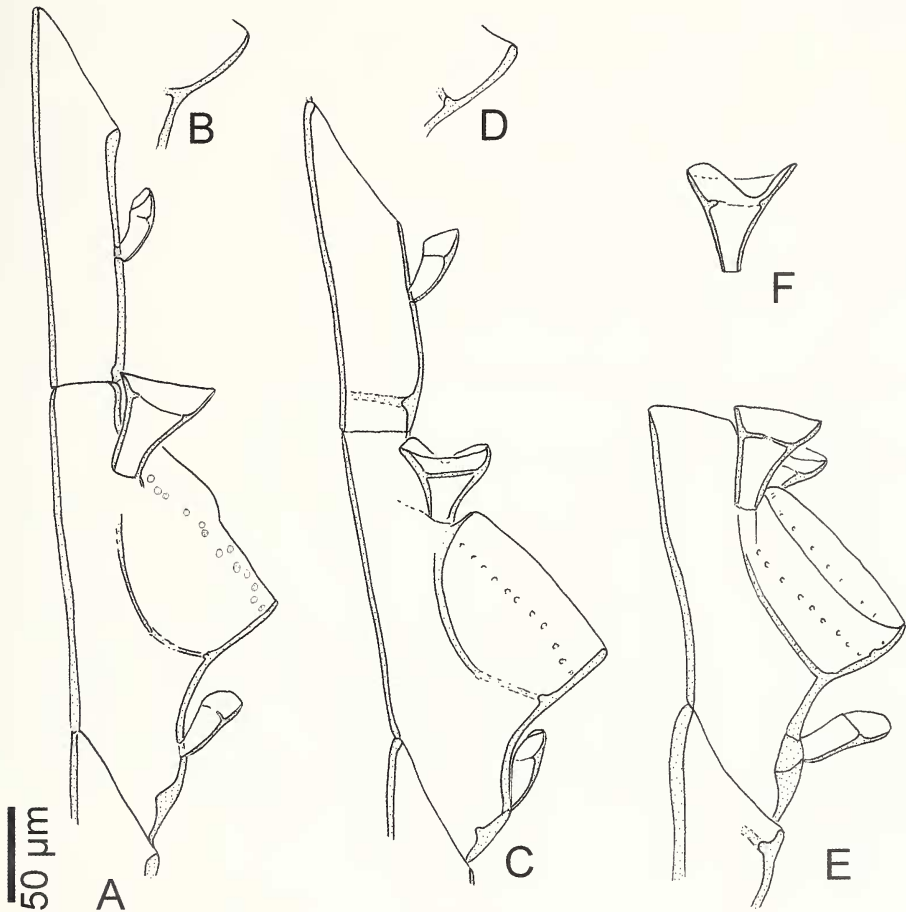


FIG. 2

Plumularia mooreana n. spec., scale bar applies to all drawings. (A) Main- and intersegment of hydrocladium, holotype. (B) Abcauline wall of hydrotheca, holotype. (C) Main- and intersegment of hydrocladium, FU-6730. (D) Abcauline wall of hydrotheca, FU-6730. (E) Main segment of hydrocladium, holotype. (F) Lateral nematotheca in adcauline view, holotype.

the abcauline hydrothecal wall is either straight or often concave (comp. Figs 2D and 3D), the portion of the main segments distal to the hydrotheca is distinctly longer (comp. Figs 2A, C and 3B, C), the intersegments are much longer (comp. Figs 2A, C and 3B, C), and the gonothecae are much smaller and carried on the stem region provided with hydrocladia.

The conspicuously funnel-shaped lateral nematothecae is another character which distinguishes *P. mooreana* from all *Plumularia* species discussed above (Fig. 2F).

The distinct ring of desmocytes (Figs 2A, C, E) is not unique to *P. mooreana*, being also present in other species (see Schuchert, 2013). What is rather special, is its

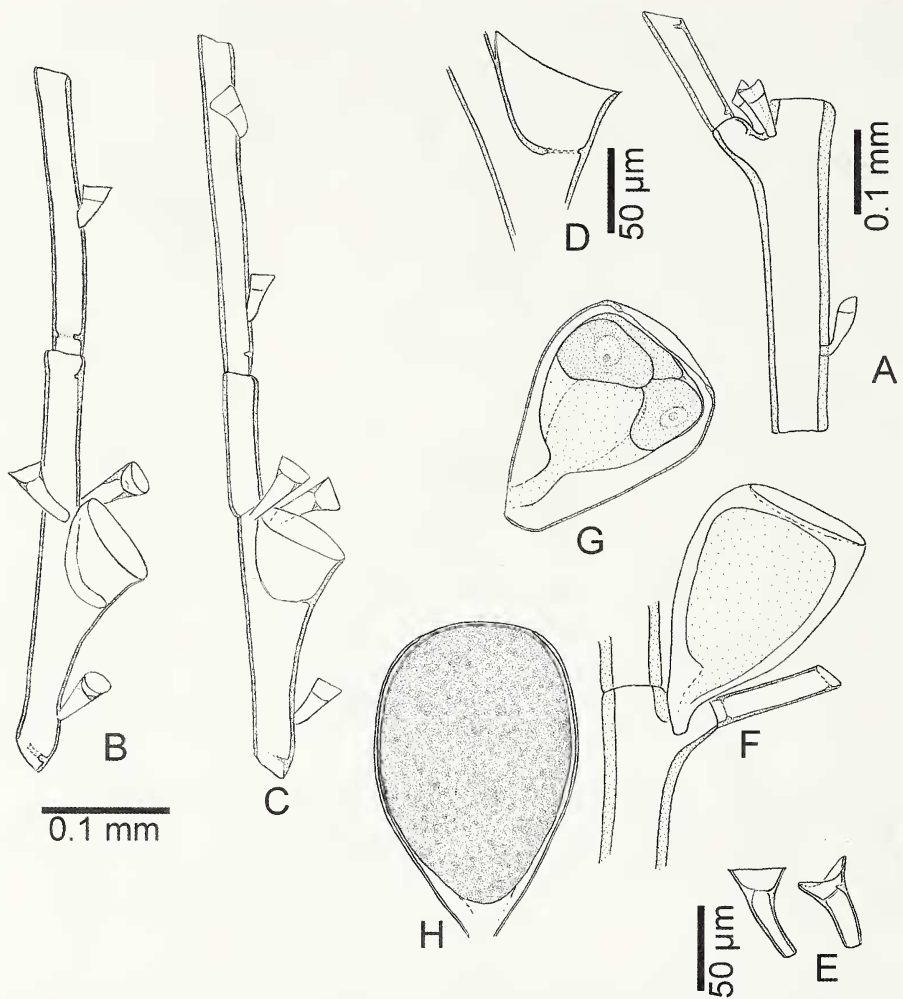


FIG. 3

Plumularia strobilophora Billard, 1913, syntypes ZMA-4014. (A) Segment of stem with first, athecate segment of a hydrocladium. (B-C) Main- and intersegment of hydrocladium. (D) Hydrotheca. (E) Lateral hydrothecae, same scale as D. (F-G) Female gonothecae, same scale as A. (H) Male (?) gonotheca, same scale as A.

position in the upper half of the hydrotheca. Usually it is located near its base and rather inconspicuous.

DISTRIBUTION: French Polynesia (this study), Fiji Islands (Ryland & Gibbons, 1991); depth 0-20 m.

***Plumularia strobilophora* Billard, 1913**

Fig. 3

Plumularia strobilophora Billard, 1913: 35, fig. 26, Indonesia. – Vannucci, 1951: 87, pl. 3 figs. 17-18. – Vervoort & Vasseur, 1977: 80, fig. 33.

Plumularia strobilifera. – Billard, 1933: 23, fig. 9. – Schmidt, 1972: 43. [misspellings] not *Plumularia strobilophora*. – Ryland & Gibbons, 1991: 536, fig. 8. [= *P. mooreana*]

SYNTYPE MATERIAL: Naturalis Museum Leiden (The Netherlands); registration number ZMA-4014; Siboga Expedition station 257; at least 2 colonies, one female growing on the hydroids *Idiellana pristis*, another putatively male on *Diphasia* spec.

TYPE LOCALITY: Duroa Strait, Kai (Kei) Islands, Indonesia, 52 m depth.

DIAGNOSIS: Small, *Plumularia setacea*-like hydroid, distinguishable through the very long first hydrocladial segment (athecate segment), the presence of two or more axillar nematothecae, the long distal part of the main segment (may be separated by a node), the much smaller, conical gonothecae with their broadly truncate end (in *P. setacea* bottle-shaped). The hydrocladial intersegments are long and have 1-2 nematothecae. In addition, all dimensions are distinctly smaller than in *P. setacea* (comp. Schuchert, 2013).

DISTRIBUTION: Banda Sea, Gulf of Suez, Philippines, French Polynesia, Brazil (Vervoort & Vasseur, 1977).

TABLE 1: Dimensions (ranges of values) of the species examined for this study. For more details see Schuchert (2013)

character	<i>P. mooreana</i>	<i>P. strobilophora</i>
plume height [mm]	10-24	12
approximate number of hydrocladia	20-36	24
length of cauline segments [μm]	210-240	290-370
diameter of cauline segments [μm]	100-130	50-80
length of first hydrocladial segment [μm]	75-110	120-150
length of main segments [μm]	200-240	280-320
length of intersegments [μm]	120-175	240-290
depth of hydrotheca [μm]	45-50	45-50
diameter of hydrotheca [μm]	100-115	80
Height of lateral nematothecae [μm]	35-50	50-60
length gonotheca [μm]	850-1000	female 250, male (?) 290

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REFERENCES

- ALLMAN, G. J. 1877. Report on the Hydroida collected during the Exploration of the Gulf Stream by L. F. de Pourtalès, Assistant United States Coast Survey. *Memoirs of the Museum of Comparative Zoölogy* 5: 1-66, plates 1-34.
- ALLMAN, G. J. 1885. Description of Australian, Cape and other Hydroids, mostly new, from the collection of Miss H. Gatty. *Journal of the Linnean Society* 19: 132-161.
- BALE, W. M. 1884. Catalogue of the Australian hydroid zoophytes. *Sydney, Australian Museum Catalogue* No. 8: 1-198, plates 1-19.
- BALE, W. M. 1888. On some new and rare Hydroida in the Australian Museum collections. *Proceedings of the Linnean Society of New South Wales* ser 2 volume 3: 745-799, plates 712-721.

- BILLARD, A. 1913. Les Hydroides de l'expédition du SIBOGA. I Plumulariidae. *Siboga Expeditie* 7a: 1-115, plates 1-6.
- BILLARD, A. 1933. Les hydroïdes des golfes de Suez et d'Akaba. *Mémoires de l'Institut d'Égypte* 21: 1-30, pl. 31.
- CALDER, D. R. 1997. Shallow-water hydroids of Bermuda: superfamily Plumularioidea. *Royal Ontario Museum Life Sciences Contributions* 161: 1-86.
- CALDER, D. R., VERVOORT, W. & HOCHBERG, F. G. 2009. Lectotype designations of new species of hydroids (Cnidaria, Hydrozoa), described by C.M. Fraser, from Allan Hancock Pacific and Caribbean Sea Expeditions. *Zoologische Mededelingen* 83: 919-1054.
- FRASER, C. M. 1937. Hydroids of the Pacific coast of Canada and the United States. *The University of Toronto Press, Toronto*, pp. 208, pls 1-44.
- FRASER, C. M. 1938. Hydroids of the 1934 Allan Hancock Pacific Expedition. *Allan Hancock Pacific Expeditions* 4: 1-105.
- FRASER, C. M. 1944. Hydroids of the Atlantic coast of North America. *The University of Toronto Press, Toronto*, pp. 1-451, pls 1-94.
- FRASER, C. M. 1948. Hydroids of the Allan Hancock Pacific Expeditions since March, 1938. *Allan Hancock Pacific Expeditions* 4: 179-343.
- HIROHITO, EMPEROR OF JAPAN 1995. The hydroids of Sagami Bay II. Thecata. *Biological Laboratory of the Imperial Household, Tokyo*, pp. I-III, 1-354, pls 1-13.
- JARVIS, F. E. 1922. The hydroids from the Chagos, Seychelles and other islands and from the coasts of British East Africa and Zanzibar. *Transactions of the Linnean Society of London, Zoology* 18: 331-360, plates 24-26.
- LAMARCK, J. B. 1816. Histoire naturelle des animaux sans vertèbres. *Verdière, Paris*, pp. 1-568.
- LAMOUREUX, J. V. F. 1824. Description des polypiers flexibles. In: J.R.C. QUOY & J.P. GAIMARD, eds, *Zoologie*. Pp. 603-643, plates 88-95.
- LINNAEUS, C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species cum characteribus, differentiis, synonymis, locis*. Edition decima, reformata. *Holmiae, Laurentii Salvii*, pp. 1-823.
- MAMMEN, T. A. 1967. On a collection of Hydroids from Southern India. III Family Plumulariidae. *Journal of the Marine Biological Association of India* 7: 291-324.
- MIGOTTO, A. E. 1996. Benthic shallow-water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastião, Brazil, including a checklist of Brazilian hydroids. *Zoologische Verhandelingen, Leiden* 306: 1-125.
- MILLARD, N. A. H. 1975. Monograph on the Hydroida of southern Africa. *Annals of the South African Museum* 68: 1-513.
- NUTTING, C. C. 1900. American Hydroids. Part I The Plumularidae. *Smithsonian Institution, United States National Museum Special Bulletin* 4: 1-285.
- NUTTING, C. C. 1906. Hydroids of the Hawaiian Islands collected by the steamer Albatross in 1902. *Bulletin of the United States Fish Commission for 1903* 23: 931-959, plates 1-13.
- NUTTING, C. C. 1927. Report on Hydroida collected by the United States Fisheries steamer Albatross in the Philippine region 1910. In: Contributions to the biology of the Philippine Archipelago and adjacent regions, part 3. *Bulletin of the United States National Museum* 100: 195-242.
- PEÑA CANTERO, A. L., SENTANDREU, V. & LATORRE, A. 2010. Phylogenetic relationships of the endemic Antarctic benthic hydroids (Cnidaria, Hydrozoa): what does the mitochondrial 16S rRNA tell us about it? *Polar Biology* 33: 41-57.
- PICTET, C. 1893. Etude sur les hydraires de la Baie d'Amboine. *Revue suisse de Zoologie* 1: 1-64.
- RALPH, P. M. 1961. New Zealand thecate hydroids. Part IV.- The family Plumulariidae. *Transactions of the Royal Society of New Zealand, Zoology* 1: 19-74.
- RAMIL, F. & VERVOORT, W. 1992. Report on the Hydroida collected by the 'BALGIM' expedition in and around the Strait of Gibraltar. *Zoologische Verhandelingen* 277: 1-262.

- RYLAND, J. S. & GIBBONS, M. J. 1991. Intertidal and shallow water hydroids from Fiji. 2. Plumulariidae and Aglaopheniidae. *Memoirs of the Queensland Museum* 30: 525-560.
- SCHMIDT, H. E. 1972. Some new records of hydroids from the Gulf of Aqaba with zoogeographical remarks on the Red Sea area. *Journal of the Marine Biological Association of India* 13: 27-51.
- SCHUCHERT, P. 1997. Review of the family Halopterididae (Hydrozoa, Cnidaria). *Zoologische Verhandelingen, Leiden* 309: 1-162.
- SCHUCHERT, P. 2012. World Hydrozoa database. Accessed through: Schuchert, P. (2009), World Hydrozoa database at <http://www.marinespecies.eu/hydrozoa>, December 2012.
- SCHUCHERT, P. 2013. The status of *Plumularia lagenifera* Allman, 1885 (Cnidaria, Hydrozoa) and related species. *Zootaxa* 3613(2): 101-124.
- VANNUCCI, M. 1951. Hydrozoa e Scyphozoa existente no Instituto Paulista de Oceanografia. *Boletim do Instituto Paulista de Oceanografia* 2: 69-100, plates 1-4.
- VERVOORT, W. & VASSEUR, P. 1977. Hydroids from French Polynesia with notes on distribution and ecology. *Zoologische Verhandelingen, Leiden* 159: 3-98.
- VERVOORT, W. & WATSON, J. E. 2003. The marine fauna of New Zealand: Leptothecata (Cnidaria: Hydrozoa) (thecate hydroids). *NIWA Biodiversity Memoir* 119: 1-538.
- WATSON, J. E. 1973. Pearson Island expedition 1969. 9. Hydroids. *Transactions of the Royal Society of South Australia* 97: 153-200.